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# Streamside Bird Community Integrity in Allegheny Portage Railroad National Historic Site

*Eastern Rivers and Mountains Network 2007-2009 Summary Report*

Natural Resource Data Series NPS/ERMN/NRDS—2010/XXX

**ON THE COVER**
Streamside bird transect along Millstone Run, Allegheny Portage Railroad National Historic Site, May 2007.
Photograph by: Matt Marshall.

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February 2010

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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Please cite this publication as:

Marshall, M. R. and B. J. Mattsson 2010. Streamside Bird Community Integrity in Allegheny Portage Railroad National Historic Site: Eastern Rivers and Mountains Network 2007-2009 Summary Report. Natural Resource Data Series NPS/ERMN/NRDS—2010/XXX. National Park Service, Fort Collins, CO.

NPS 620/XXXXXX, February 2010

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# Abstract

In 2007, the Eastern Rivers and Mountains Network (ERMN) of the National Park Service (NPS) began monitoring streamside bird communities along wadeable streams throughout seven of its nine member parks. Streamside bird monitoring was initiated in Allegheny Portage Railroad National Historic Site (ALPO) in 2007 along Millstone Run. Additional sites were added in 2008 and 2009, respectively, for a total of three sites. This monitoring effort is a component of the ERMN "vital signs" monitoring program and part of the nationwide NPS Inventory and Monitoring Program.

The purpose of the streamside bird monitoring protocol is to quantify the spatiotemporal distribution of Louisiana waterthrush and other representative members of the bird community existing along ERMN tributaries to help maintain or improve condition of ERMN natural resources (i.e., flowing surface waters and the watersheds that they drain).

This report was intended to provide preliminary results of the first three years of monitoring to the natural resource manager and other interested parties of ALPO.

Louisiana waterthrush and Louisiana waterthrush breeding pairs appear to regularly occur along Millstone Run and also occurred along both transect intervals of Blair Gap Run (Muleshoe) in 2009. These estimates suggest that the distribution and abundance of Louisiana waterthrush in ALPO is high and similar to that of pH-neutral streams in other parts of the ERMN and region. In contrast, a lone, unpaired male was the only Louisiana waterthrush detected along UNT to Blair Gap Run (Foot of Ten) during two years of sampling.

Based on songbird species detected at point-count stations in ALPO during spring and early summer 2007-2009, two tributaries host a diverse avian community that likely indicates high ecological integrity. In particular, these tributaries host bird species assemblages with life history attributes that are typically associated with forested areas of the region. In contrast, the bird community present along UNT to Blair Gap Run (Foot of Ten) scored "medium integrity" indicating the bird community is comprised of fewer forest specialist species and more forest generalist species.

# Introduction

In 2007, the Eastern Rivers and Mountains Network (ERMN) of the National Park Service (NPS) began monitoring streamside bird communities along wadeable streams throughout seven of its nine member parks. This monitoring effort is a component of the ERMN "vital signs" monitoring program (Marshall and Piekielek 2007) and part of the nationwide NPS Inventory and Monitoring Program (Fancy et al. 2009).

One of the primary objectives of the ecological monitoring program in the ERMN is to evaluate status and trends in the condition of tributary watersheds flowing into and through member parks. Watershed condition is evaluated using measures of ecosystem integrity, including streamside bird species and communities (Mattsson and Marshall 2009b), forest structure and composition (Perles et al. 2009), stream benthic macroinvertebrates (Tzilkowski et al. 2009), stream chemistry, and watershed landuse, type, and configuration (Marshall and Piekielek 2007).

The purpose of the streamside bird monitoring protocol is to quantify the spatiotemporal distribution of Louisiana waterthrush (LOWA; scientific names for all species are in Appendix A) and other representative members of the bird community existing along ERMN tributaries to help maintain or improve condition of ERMN natural resources (i.e., flowing surface waters and the watersheds that they drain).

Louisiana waterthrush monitoring was recognized as a top priority at the network level during the vital signs prioritization process by NPS personnel and other scientists (Marshall and Piekielek 2007). This is the only bird species in the ERMN that depends on flowing waters for food and reproduction (Robinson 1995). In particular, LOWAs may respond to the composition of the benthic macroinvertebrate community, as they are more likely to occupy streams with a prey biomass containing a higher proportion of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) (EPT; Mattsson et al. 2009). EPT taxa typically decline following human impacts such as sedimentation (Wood and Armitage 1997, Roy et al. 2003) or acidification (Mulholland et al. 1992, Griffith et al. 1995). Indeed, breeding density and pairing success of LOWAs is lower along acidified compared to pH-neutral streams (Mulvihill et al. 2008). Furthermore, LOWAs are more likely to occur along streams embedded within wide (e.g., > 80 m) tracts of closed-canopy deciduous or mixed deciduous-coniferous forest (Mattsson 2006). Thus, LOWAs serve as indicators of local riparian ecosystem integrity. As such, standardized monitoring of LOWA population parameters is becoming accepted as a desirable component of an integrated long-term water quality and watershed condition monitoring program (Stucker 2000, Mattsson and Cooper 2006, Mulvihill et al. 2008).

Monitoring other breeding bird species was identified initially as a lower priority vital sign for the ERMN (Marshall and Piekielek 2007). However, bird community monitoring can be efficiently and cost effectively incorporated into a LOWA monitoring protocol. Hence, the decision to develop a "streamside bird" protocol for both LOWA and other riparian breeding birds (Mattsson and Marshall 2009b). Birds can serve as cost-effective indicators of ecosystem condition due to their relative conspicuousness and responsiveness to ecological gradients (Roberge and Angelstam 2006).

This report was intended to provide preliminary results of the first three years of monitoring to the natural resource manager of Allegheny Portage Railroad National Historic Site (ALPO). At the time that this report was prepared, the streamside monitoring protocol (Mattsson and Marshall 2009b) had been developed, written, field-tested, and had received both internal and external peer review. The protocol had not, however, undergone the final peer review process. The preliminary nature of data presented in this report should be considered prior to its use or dissemination.

Primary objectives of this report are to:

1. Report stream-reach scale detections of focal bird species in selected watersheds of ALPO.

2. Present the Bird Community Index of biotic integrity for individual stream reaches in ALPO.

# Methods

Although a brief overview of the streamside bird monitoring methods is provided here, detailed rationale of the sampling design and field methods, in addition to Standard Operating Procedures, are provided in the protocol (Mattsson and Marshall 2009a).

### Site Selection

In total, 3 streams were selected for monitoring in ALPO using both a random and "targeted" site selection strategy (Mattsson and Marshall 2009a) in consultation with Kathy Penrod (ALPO Natural Resource Specialist). The first randomly selected site is a 1-km transect located on Millstone Run, a tributary to ALPO's largest stream Blair Gap Run. Monitoring began on this stream in 2007. The second randomly selected site is a 500m transect established along the downstream section of an unnamed stream near Foot of Ten above its confluence with Blair Gap Run. Monitoring began on this transect in 2008. The third site is also a 500m transect along a stretch of Blair Gap Run that is within park boundaries near the Hollidaysburg (Muleshoe) reservoir. This site was a targeted site given that it is one of the only reaches of Blair Gap Run to occur on park property. Monitoring began here in 2009.

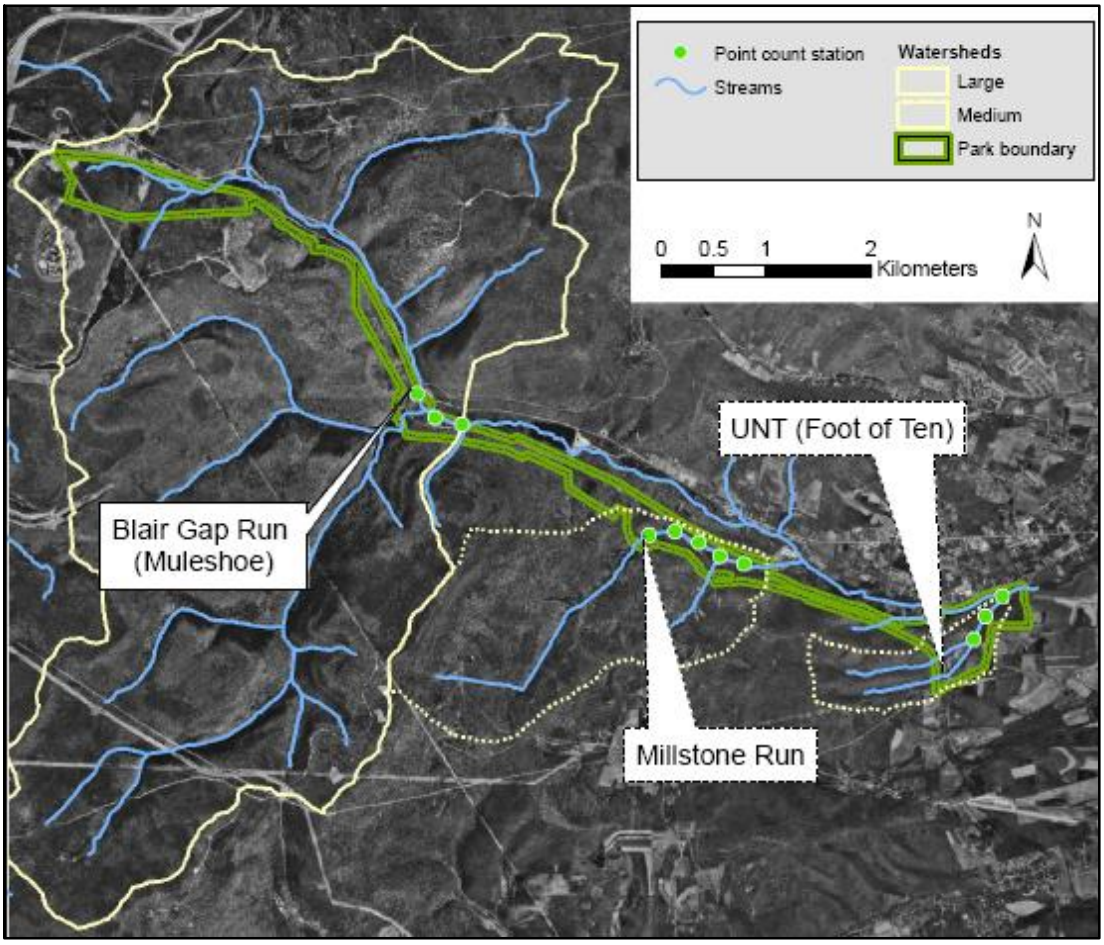



**Figure 1.** Point transects selection for monitoring streamside birds at ALPO.

These streamside transects were divided into 250-m intervals, within which use and occupancy by Louisiana waterthrush was estimated. Variable circular plot (VCP) point count stations were established along each streamside transect (separated by 250 m of stream) to estimate the spatiotemporal distribution of the remaining bird species and guilds (Figure 2).

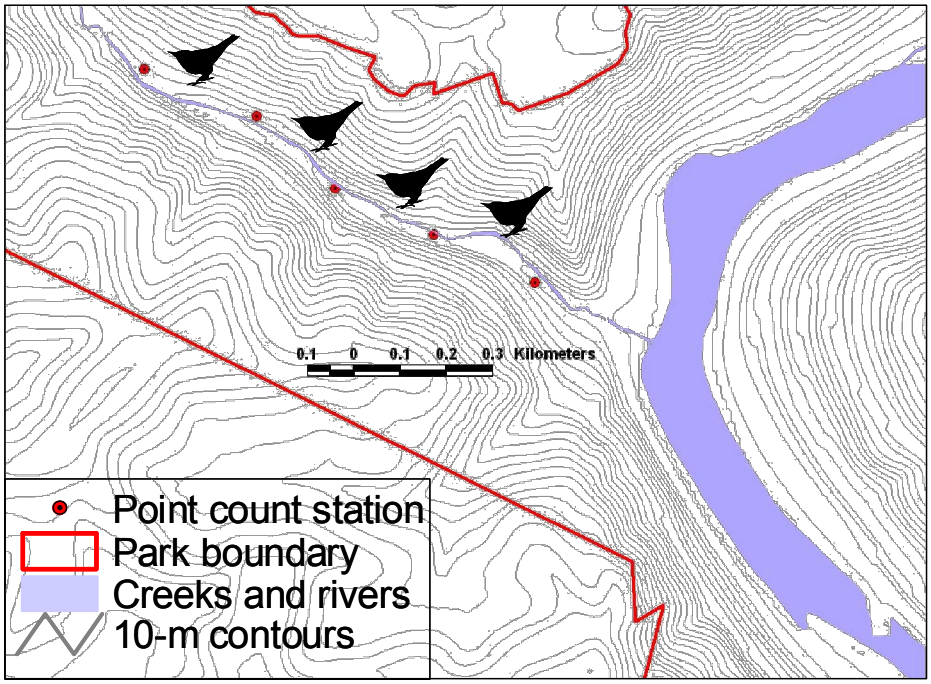



**Figure 2.** Example of a streamside bird monitoring sampling site, which consists of a 1-km streamside point transect with five point-count stations that delineate four 250-m intervals (indicated by LOWA silhouettes). The site depicted is Arbuckle Creek at New River Gorge National River.

## Streamside bird surveys

Each streamside transect was visited on four days per year during spring/early summer. Transect surveys to document LOWAs (see below) were conducted on all four visits. Point count surveys to document all other streamside breeding birds (see below) were conducted only during the third and fourth visits. During each visit, an observer traversed the transect twice (i.e., upstream and downstream) collecting data on LOWA and, during the third and fourth visits, also conducted a 5-minute point count at each of the 2-5 point count stations on both passes along the transect. Each transect, therefore, had two subsamples (passes) within each visit day, for a total of 8 transect-visit occasions and 4 point-count visit occasions per year. Each visit began at sunrise and ended 4-5 hr after sunrise. All data from ALPO was collected by Matt Marshall all three years.

### *LOWA transect surveys*

Observers walked each transect in a slow and methodical manner to detect LOWAs. Each detection was documented on field datasheets by recording the location, pairing status, age, height relative to ground or stream, distance and direction (i.e., left or right) from the main

channel, and ancillary information to support location and pairing status assignment (e.g., interactions with other LOWAs).

The first two visits occurred during early spring (roughly March 30 through April 29) which corresponds with LOWA spring migratory arrival to the parks, territory establishment, pairing, and nest building. The period ends when most paired females begin incubating a clutch of eggs. Males are very vocal during this period and they spend much of their time guarding their mate, foraging, and inspecting potential nest sites. The timing of, and bird behavior during, this period maximizes the potential of detecting LOWAs and LOWA pairs if they are present. The two transect visits during this period were separated by approximately two weeks.

The third and fourth visits to each transect occurred during late spring / early summer (roughly May 27 through June 26), which corresponds with the peak LOWA fledging period. LOWA pairs are therefore very active during this period while tending young. These two transect visits were also separated by approximately two weeks.

#### *Point count surveys*

Point count surveys were conducted concurrent with LOWA transect surveys during the third and fourth visits to each transect. This period (roughly May 27 through June 26) corresponds to the period when the majority of streamside birds have completed spring migration and commenced breeding activities which includes frequent singing by males (which, again, increases the chances the bird will be detected given that it is present). While walking each transect, observers stopped at each point count station and conducted the 5-minute point count. During point counts, observers recorded the following information for each individual bird detected: 1) species identity, 2) type of detection (i.e., singing, calling, drumming, or visual), and 3) whether it was first detected within < 50 m, 50 – 75 m, or > 75 m of the point count station. Observers paused for 5 minutes at the upstream or downstream end of each transect before conducting the point counts of the second pass.

### Data analysis

#### *Streamside Bird Surveys*

LOWA transect surveys: Distribution and density of LOWA and LOWA breeding pairs have been shown to be indicators of spatial variation in stream ecosystem integrity (Mattsson and Cooper 2006, Mulvihill et al. 2008). Though not yet examined, changes over time in distribution and abundance of LOWA and LOWA pairs likely reflect changes in stream ecosystem integrity. Because LOWA territories extend 250 m of stream in at least portions of the ERMN (Mattsson et al. 2009), detections of all LOWAs and of LOWA pairs within each 250-m transect interval were summarized and considered an index of the spatiotemporal distribution of LOWA along tributary streams in ALPO. The current analysis does not correct for detection biases.

Point-count surveys: Fluctuations in distribution and abundance of neotropical migratory forest-interior songbird species likely reflect ecosystem changes on their breeding grounds, migratory routes, and/or wintering grounds (Jones et al. 2003). Species and guild-specific patterns may indicate particular changes, such as frequency of tree fall gaps, tree species composition, forest structure, and stream ecosystem integrity. As an example of the type of analyses possible, unlimited-radius detections of canopy-nesting forest-interior obligate (CNFI)

songbirds were summarized. This guild contains a highly specialized group of species (species that are BOTH forest-interior obligate breeders AND nest in the canopy; Table 1) that have been shown to decline following forest disturbance (O'Connell et al. 2000). This analysis focused on four of the eight species within the CNFI guild that had sufficiently high detection probabilities for precise estimates based on preliminary analysis of New River Gorge National River and Gauley River National Recreation Area data (Mattsson and Marshall 2009a). Unlimited-radius detections of LOWAs during point counts were also summarized for a comparison to detections during transect surveys.

### *Bird Community Index of Biotic Integrity*

In addition to the guild and species-specific analysis above, the point-count survey data are amenable to an application of a recently developed index of biotic integrity based on breeding birds. O'Connell et al. (2000) developed a Bird Community Index (BCI) of biotic integrity based on detections of songbird species (henceforth species; orders Columbiformes [doves and pigeons], Cuculiformes [cuckoos], Apodiformes [swifts and hummingbirds], Piciformes [woodpeckers], and Passeriformes [perching birds]) in the Mid-Atlantic Highlands (MAH). The BCI is applicable to ALPO which are entirely contained within the MAH. The index integrates relative proportions of species belonging to predefined sets of behavioral and physiological response guilds (Table 2, Appendix A) to determine the BCI score for a 1-km transect. If an assemblage of detected species is dominated by specialist guilds (e.g., forest-interior obligate species, insectivores, single brooders, etc.), then the BCI score is highest. In contrast, the score is lowest if the assemblage is dominated by generalist guilds (e.g., resident species, omnivores, etc.). Such an index provides a coarse assessment and potentially reveals ecosystem-level status and changes along a disturbance gradient from "pristine" or "natural" (i.e., forested) to "highly disturbed" or "urban." This assessment is based on species life history attributes rather than species vulnerability *per se* and therefore aims to provide a snapshot of ecological condition at a landscape scale.

A BCI score is the sum of rankings (range: 1-5, with 1 being low integrity and 5 being highest integrity) for proportional species richness within 16 ecological guilds that comprise three guild types (Table 2), including compositional (e.g., resident species such as hairy woodpecker), functional (e.g., bark-probing insectivores such as black-and-white warbler), and structural (e.g., forest ground-nesting species such as Louisiana waterthrush). Some guilds have a minimum rank $> 1$ and a maximum rank $< 5$ (Table 2), and so BCI scores can theoretically range from 20.5 to 74. Following O'Connell et al. (1998, 2000), BCI scores are categorized and interpreted as follows: "low integrity" (20.5 – 40.0), "medium integrity" (40.1 – 52.0), "high integrity" (52.1 – 60.0), or "highest integrity" (60.1 – 74).

**Table 1.** Forest-interior canopy-nesting songbird species expected to breed in ALPO. Red-eyed vireo classified as forest generalist by O'Connell et al. (1998), but treated as forest interior obligates here, because other literature indicates that they are more abundant in large forest tracts compared to small forest fragments (Cimprich et al. 2000). Cerulean warbler (*Dendroica cerulean*) has not been detected at ALPO. Proposed sentinel species are highlighted in bold type. See Appendix A for scientific names.

| Species | Code |
|---|---|
| **Acadian Flycatcher** | **ACFL** |
| American Redstart | AMRE |
| Blackburnian Warbler | BLBW |
| **Black-throated Green Warbler** | **BTNW** |
| Blue-headed Vireo | BHVI |
| Cerulean Warbler | CERW |
| **Red-eyed Vireo** | **REVI** |
| **Scarlet Tanager** | **SCTA** |

**Table 2.** Guilds and ranking system for calculating bird community index along streamside transects in the ERMN, based on O'Connell et al. (1998, 2000). Specialist guilds indicated with asterices (*), and remaining are generalist guilds.

| Guild | Proportion of species detected | Rank | Guild | Proportion of species detected | Rank | Guild | Proportion of species detected | Rank |
|---|---|---|---|---|---|---|---|---|
| Compositional | | | Functional -- food acquisition | | | Structural | | |
| Exotic / non-native | 0 | 5.0 | Omnivore | 0.000 - 0.290 | 5.0 | Habitat association | | |
| (EXNN) | 0.001 - 0.020 | 4.5 | (OMNI) | 0.291 - 0.410 | 4.0 | Forest generalist | 0.000 - 0.280 | 4.5 |
| | 0.021 - 0.050 | 3.0 | | 0.411 - 0.480 | 3.0 | (FOGE) | 0.281 - 1.000 | 2.5 |
| | 0.051 - 0.110 | 2.0 | | 0.481 - 0.580 | 2.0 | | | |
| | 0.111 - 1.000 | 1.0 | | 0.581 - 1.000 | 1.0 | Forest-interior obligate* | 0.000 - 0.010 | 1.0 |
| | | | | | | (FIOB) | 0.011 - 0.080 | 1.5 |
| Nest predator/brood parasite | 0.000 - 0.100 | 5.0 | Bark-probing insectivore* | 0.000 - 0.060 | 1.5 | | 0.081 - 0.260 | 3.0 |
| (NPBP) | 0.101 - 0.150 | 3.5 | (BPIN) | 0.061 - 0.110 | 3.0 | | 0.261 - 0.430 | 4.0 |
| | 0.151 - 0.180 | 2.0 | | 0.111 - 0.170 | 4.0 | | 0.431 - 1.000 | 5.0 |
| | 0.181 - 1.000 | 1.0 | | 0.171 - 1.000 | 5.0 | Nest placement | | |
| | | | | | | Open ground | 0.000 - 0.020 | 1.0 |
| Resident / non-migratory | 0.000 - 0.260 | 5.0 | Ground-gleaning insectivore* | 0.000 - 0.050 | 1.5 | (OGNE) | 0.021 - 0.110 | 2.5 |
| (RENM) | 0.261 - 0.390 | 3.5 | (GGIN) | 0.051 - 0.070 | 2.0 | | 0.111 - 1.000 | 5.0 |
| | 0.391 - 0.570 | 2.0 | | 0.071 - 0.140 | 4.5 | | | |
| | 0.571 - 1.000 | 1.0 | | 0.141 - 1.000 | 5.0 | Shrub | 0.000 - 0.210 | 4.0 |
| | | | | | | (SHNE) | 0.211 - 0.330 | 1.5 |
| Temperate migrant | 0.000 - 0.210 | 4.0 | Lower-canopy insectivore | 0.000 - 0.140 | 1.5 | | 0.331 - 1.000 | 1.0 |
| (TEMI) | 0.211 - 0.300 | 2.0 | (LCIN) | 0.141 - 0.230 | 2.5 | | | |
| | 0.301 - 1.000 | 1.0 | | 0.231 - 1.000 | 5.0 | Forest ground* | 0 | 1.0 |
| | | | | | | (FGNE) | 0.001 - 0.020 | 1.5 |
| Single-brooded* | 0.000 - 0.410 | 1.5 | Upper-canopy insectivore* | 0.000 - 0.030 | 1.5 | | 0.021 - 0.160 | 3.0 |
| (SIBR) | 0.411 - 0.450 | 2.0 | (UCIN) | 0.031 - 0.050 | 2.0 | | 0.161 - 0.240 | 4.5 |
| | | | | 0.051 - 0.120 | 3.0 | | 0.241 - 1.000 | 5.0 |
| | | | | 0.121 - 0.200 | 4.5 | | | |
| | | | | 0.201 - 1.000 | 5.0 | Forest canopy* | 0.000 - 0.280 | 1.5 |
| | | | | | | (FCNE) | 0.281 - 0.320 | 2.0 |
| | | | | | | | 0.321 - 1.000 | 4.5 |

# Results

## Streamside Bird Surveys

### *LOWA transect surveys*

LOWAs and LOWA breeding pairs were detected in every interval at least once during the 2007-2009 surveys with the exception of UNT to Blair Gap Run (Foot of Ten) where there has been no evidence of a breeding pair despite the presence of a male LOWA in each of the two years surveyed (Figure 3a and b). LOWAs and LOWA breeding pairs were found along both intervals of Blair Gap Run (Muleshoe) in 2009 and found along most intervals of Millstone Run all three years (Table 3, Figure 3a and b).

Proportions of transect intervals in which all LOWAs were detected (not corrected for detection biases) varied among years (Table 3) but this pattern is largely driven by adding new transects in 2008 and 2009, respectively. The proportion of transect intervals detected in 2009 should be considered the baseline now that all three transects are established.

### *Point Count Surveys*

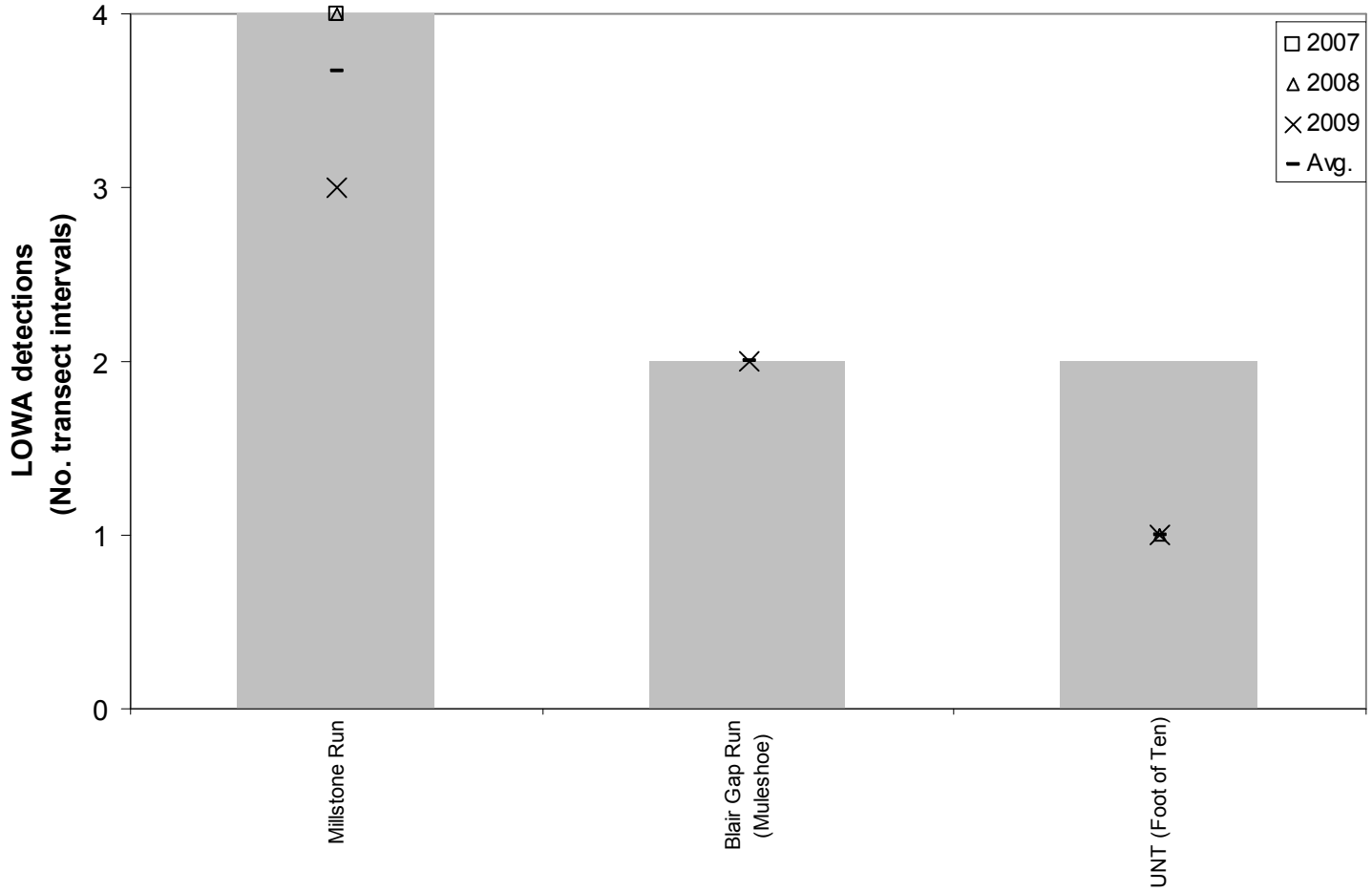
Across transects and years, 42 songbird species were detected during point counts (Appendices A and B). No non-native species were detected, and of the 13 forest-interior obligate songbird species expected to occur in ALPO based on prior detections (summarized in Mattsson and Marshall 2009b), 12 were detected during point counts (Appendix B). The exception was black-and-white warbler which was not detected along any transect during the first three years.

When considering only Millstone Run which was surveyed in all three seasons, proportions of point count stations at which canopy-nesting forest-interior species (CNFIs) were detected ranged from 0.2 to 1.0 (Figure 4). Detections of both REVI (1.0) and ACFL (0.4) remained constant across all three years while the proportion of count stations detected for SCTA and BLNW declined by 20% and 66%, respectively, across the three year period. LOWA showed fairly dramatic variability in detections at point count stations with an overall decrease in detections of 44% across the three years (Figure 4)

## Bird Community Index of Biotic Integrity

Two of the three transects were classified as “high integrity” on average while the transect along UNT to Blair Gap Run (Foot of Ten) was classified as “medium” integrity both years. Millstone Run was classified as “medium” integrity in 2008 but “high” integrity in 2007 and 2009. No transects were classified as either “highest” integrity (score of 60 or higher) or “low” integrity (score of 40 or lower). Table 5 provides the BCI scoring breakdown for Millstone Run in 2009.

**Figure 3.** Number of 250-m intervals (range: 2-4 per stream) in which LOWAs (A) and LOWA breeding pairs (B) were detected along streamside transects in ALPO, 2007-2009. Surveys along UNT to Blair Gap Run (Foot of Ten) began in 2008 and surveys along Blair Gap Run (Muleshoe) began in 2009. Bar height represents cumulative detections across years. LOWAs and LOWA breeding pairs were detected in every interval surveyed with the exception of UNT to Blair Gap Run (Foot of Ten) where there has been no evidence of a breeding pair despite the presence of a male LOWA in each of the two years surveyed.



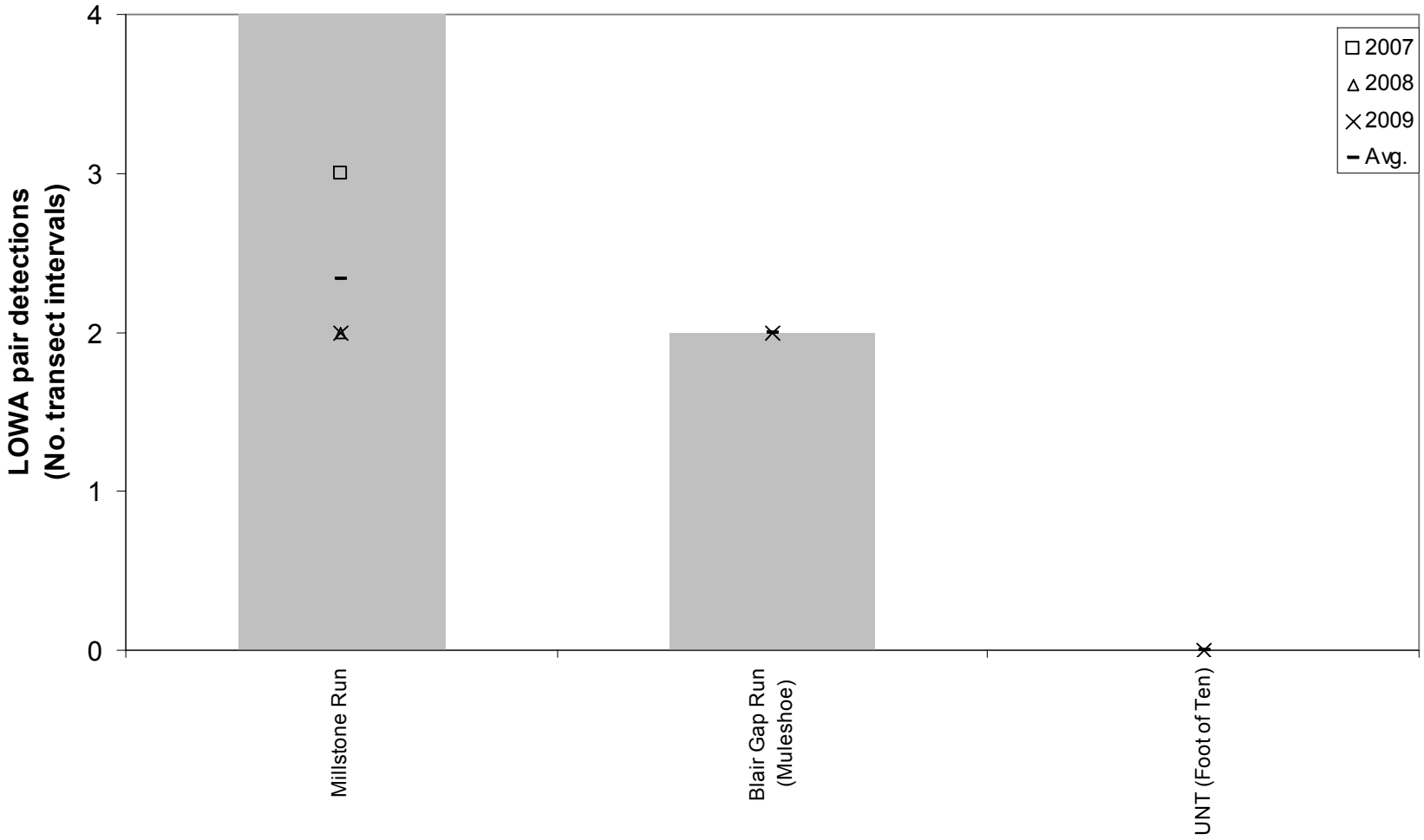

LOWA pair detections
(No. transect intervals)
4
3
2
1
0
2007
2008
2009
Avg.
Millstone Run
Blair Gap Run
(Muleshoe)
UNT (Foot of Ten)

**Table 3.** Detections of all LOWAs and of LOWA breeding pairs along tributary streams during transect surveys in ALPO, 2007-2009. Numbers of transect intervals are in parentheses. Surveys along UNT to Blair Gap Run (Foot of Ten) began in 2008 and surveys along Blair Gap Run (Muleshoe) began in 2009.

| Proportion of transect intervals detected | | | | | |
|---|---|---|---|---|---|
| All LOWAs | | | LOWA pairs | | |
| 2007 | 2008 | 2009 | 2007 | 2008 | 2009 |
| 1.00 ( 4) | 0.71 ( 7) | 0.44 ( 9) | 0.75 ( 4) | 0.29 ( 7) | 0.44 ( 9) |

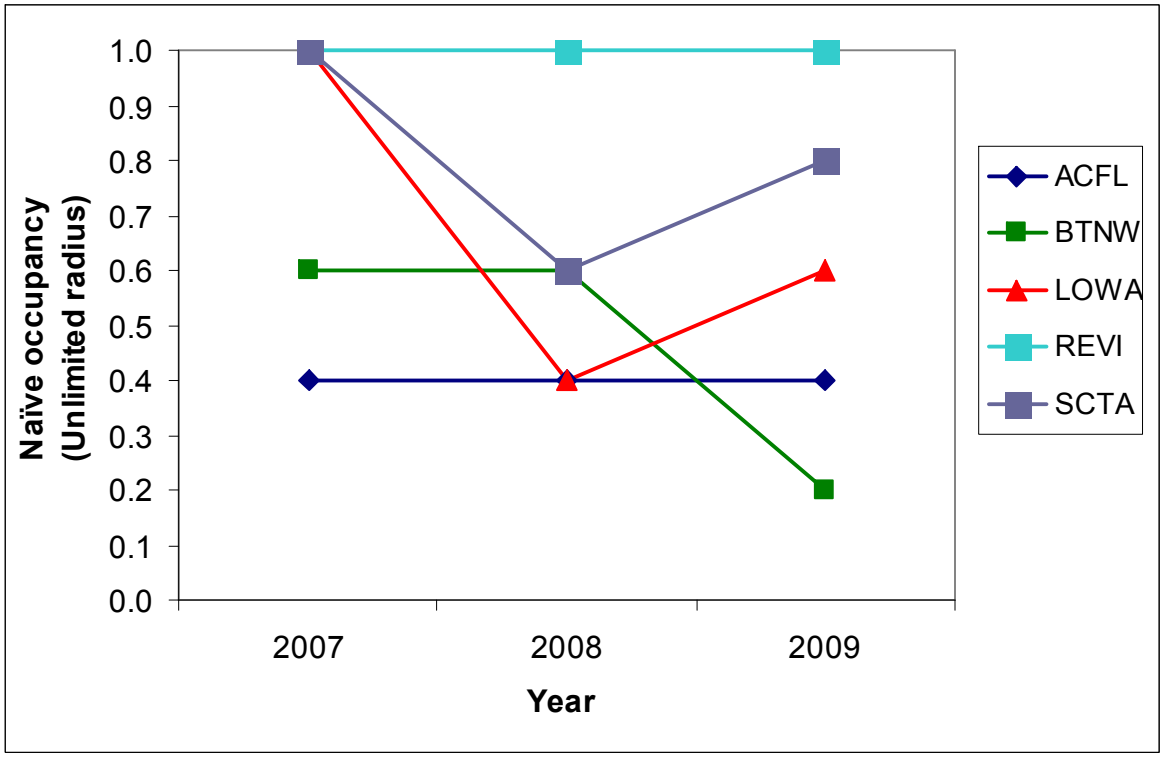



**Figure 4.** Detections of LOWA and canopy-nesting forest-interior songbird species along streamside transects in ALPO, 2007-2009. Species codes: LOWA = Louisiana waterthrush, REVI = red-eyed vireo, ACFL = Acadian flycatcher, SCTA = scarlet tanager, BTNW = black-throated green warbler.

**Table 4.** Number of forest-interior obligate species detected and Bird Community Index (BCI) classifications based on detections at point count stations along tributary streams in ALPO, 2007-2009. Numbers of transects are in parentheses. Averages for BCI classifications are the number of sites in each BCI classification based on the mean BCI across years for each site. Surveys along UNT to Blair Gap Run (Foot of Ten) began in 2008 and surveys along Blair Gap Run (Muleshoe) began in 2009.

| Year | No. forest-interior species | Percent of transects per BCI classification | | | |
|---|---|---|---|---|---|
| | | Low integrity | Med. integrity | High integrity | Highest integrity |
| 2007 | 9 | 0.0 ( 0) | 0.0 ( 0) | 100.0 ( 1) | 0.0 ( 0) |
| 2008 | 10 | 0.0 ( 0) | 100.0 ( 2) | 0.0 ( 0) | 0.0 ( 0) |
| 2009 | 11 | 0.0 ( 0) | 33.3 ( 1) | 66.7 ( 2) | 0.0 ( 0) |
| Avg. | 10.0 | 0.0 ( 0) | 33.3 ( 1) | 66.7 ( 2) | 0.0 ( 0) |

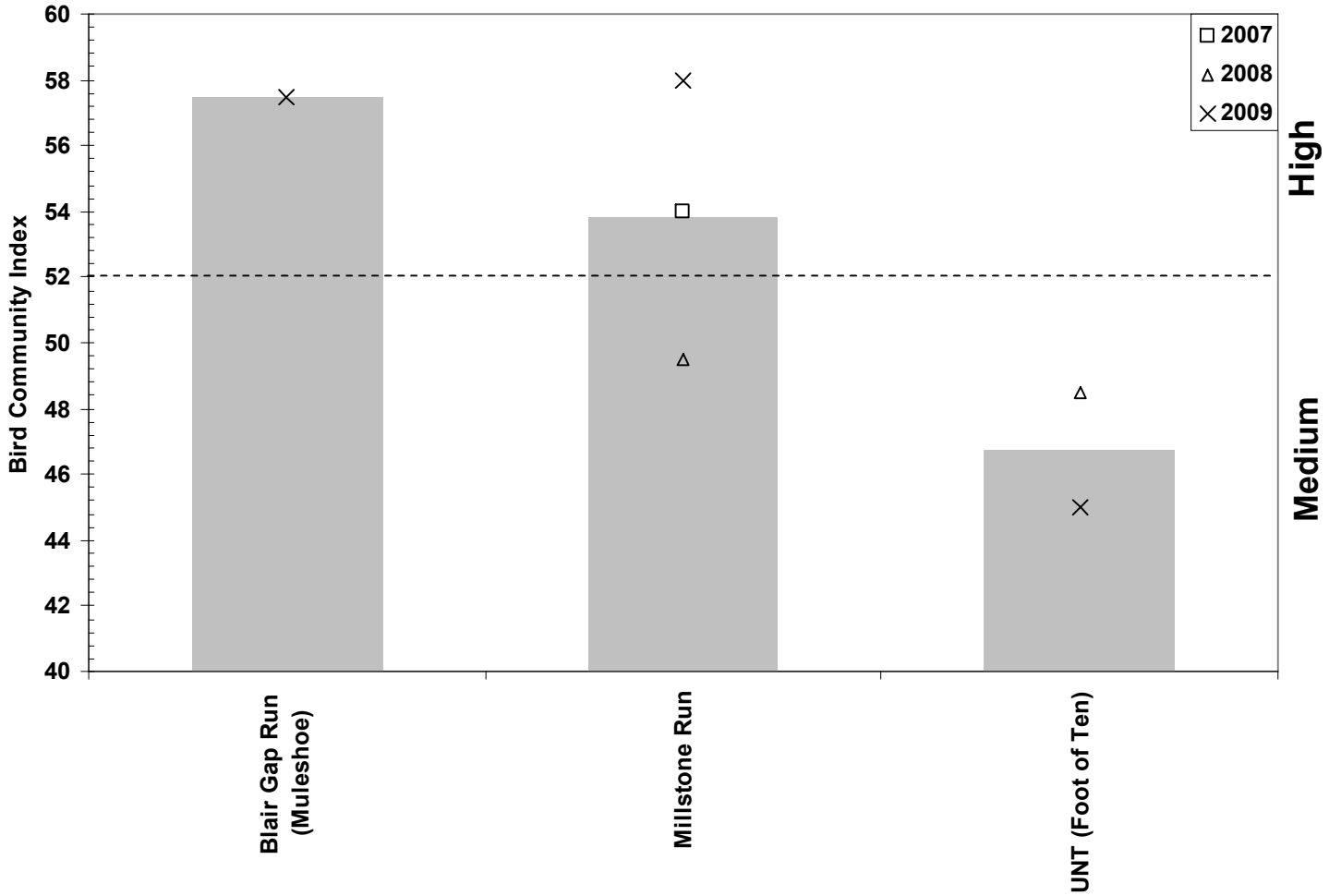



**Figure 5.** Bird Community Index (BCI) scores for streamside transects in ALPO, 2007-2009. Bar height represents BCI averaged across years Dashed horizontal lines divide ranges of scores indicating medium and high biotic integrity. Surveys along UNT to Blair Gap Run (Foot of Ten) began in 2008 and surveys along Blair Gap Run (Muleshoe) began in 2009.

**Table 5.** Bird community composition and scores used for calculating bird community index of 58 (i.e., "high integrity") for Millstone Run 2009. Specialist guilds indicated with astrices (*), and the remaining are generalist guilds. Higher scores indicate higher ecological integrity. See Table 2 for scoring system.

| Guild category | Proportion of species | Score |
|---|---|---|
| Compositional | | |
| Exotic / non-native | 0.000 | 5.0 |
| Nest predator / brood parasite | 0.077 | 5.0 |
| Resident / non-migratory | 0.385 | 3.5 |
| Temperate migrant | 0.115 | 4.0 |
| Single-brooded* | 0.500 | 3.0 |
| Functional -- food acquisition | | |
| Omnivore | 0.346 | 4.0 |
| Bark-probing insectivore* | 0.154 | 4.0 |
| Ground-gleaning insectivore* | 0.077 | 4.5 |
| Lower-canopy insectivore* | 0.154 | 2.5 |
| Upper-canopy insectivore* | 0.115 | 3.0 |
| Structural | | |
| Habitat association | | |
| Forest-generalist | 0.462 | 2.5 |
| Forest-interior obligate* | 0.385 | 3.0 |
| Nest placement | | |
| Open ground | 0.038 | 2.5 |
| Shrub | 0.192 | 4.0 |
| Forest ground* | 0.115 | 3.0 |
| Forest canopy* | 0.423 | 4.5 |

# Discussion

## Species-specific patterns

### *LOWA Transect surveys*

Based on the first three years of monitoring, LOWAs and LOWA breeding pairs appear to regularly occur along Millstone Run and also occurred along both transect intervals of Blair Gap Run (Muleshoe) in 2009; the only year sampled thus far. Assuming that these detections reflect actual LOWA territory density (i.e., territory density = interval occupancy * 1 km), distribution and abundance of LOWA at these two sites in ALPO is high and similar to that of pH-neutral streams in other parts of the region (Mulvihill et al. 2008). In contrast, a lone, unpaired male was the only LOWA detected along UNT to Blair Gap Run (Foot of Ten) during two years of sampling. This stream is lower gradient and can become dry during early summer during some years (M.R. Marshall personal observation) perhaps influencing the habitat quality for LOWA. Moreover, the forest stand along this transect appears to be much younger and contains more invasive species (e.g., *Rosa multiflora*) than the other two ALPO transects/streams (M.R. Marshall personal observation). Further monitoring that includes other vital signs (e.g., landscape dynamics and/or benthic macroinvertebrates) may reveal potential explanations for their absence along this tributary. Or perhaps, as the forest matures, LOWA may eventually establish breeding territories.

Based on modeling results from other parks in the ERMN (B. J. Mattsson unpubl. analysis), detectability (probability of detecting a LOWA or a breeding pair given that it is present) of LOWA pairs during individual passes along transect intervals is very low (ca. 10%). This low detectability is likely due to the high mobility of LOWA and their known use of habitats away from the main channel such as smaller tributaries, seeps, and upland riparian forest. As a consequence, it may prove difficult to detect changes in occupancy over time (i.e., trends). Additional modeling of transect-interval detections/occupancy by LOWAs in ALPO and other parks of the ERMN is underway.

### *Point-count surveys*

Nearly all of the expected forest interior obligate species were detected along sampled streams in ALPO. The only exceptions were black-and-white warbler (BAWW) which was not detected and American redstart (AMRE) which was only detected at one point count station along Millstone Run during one year and does not appear to be a regular breeder at ALPO despite being present in the park during other surveys (Yahner et al. 2001).

The example analysis focusing on canopy-nesting forest-interior species (CNFIs) along Millstone Run indicated that detections of these species were generally high (>40% of point count locations) and consistent over time for ACFL (0.40) and REVI (1.0). Two species showed greater variability (SCTA and BTNW) and some indication of a decline. These estimates for 2007-2009 of CFNIs at ALPO should be considered as baseline information. Detecting actual population changes will become possible when analyzing more long-term data (e.g., 5-10 years) on breeding birds along streams in ALPO and in surrounding areas. For context, however, several long-term, ecoregion-scale studies in the region that preceded this study reported model-based evidence for trends ranging from increases, declines, and stability in relative abundance of these CNFIs (Table 6; DeSante et al. 2008, Sauer et al. 2008).

**Table 6.** Population trends for canopy-nesting forest-interior songbirds encompassing ALPO according to three on ongoing monitoring programs. Statistically significant increases indicated by up arrows (↑), decreases by down arrows (↓), and non-significant changes by dashes (-). See Table 1 for species codes.

| | | | Ridge and Valley[c] | | | Allegheny Plateau[c] | | |
|---|---|---|---|---|---|---|---|---|
| **Species** | **Streamside ALPO[a]** | **Appalachians[b]** | **1966-1979** | **1980-2007** | **1966-2007** | **1966-1979** | **1980-2007** | **1966-2007** |
| ACFL | TBD | - | - | - | ↓ | - | - | - |
| BTNW | TBD | - | - | - | ↑ | - | ↑ | - |
| LOWA | TBD | - | - | ↓ | - | - | - | - |
| REVI | TBD | - | - | ↑ | ↑ | ↑ | ↑ | ↑ |
| SCTA | TBD | - | ↑ | - | ↑ | ↑ | ↓ | ↓ |

[a] Population trends to be determined (TBD) as more data are collected.
[b] Population change at mist-net stations, mark-recapture model, 1992-2003 (DeSante et al. 2008).
[c] Change in relative abundance along roadside unlimited radius point counts, based on linear regression (Sauer et al. 2008). The Ridge and Valley physiographic region encompasses ALPO and the Allegheny Plateau physiographic region is west and north of ALPO.

### Bird Community Index of Biotic Integrity

Based on songbird species detected at point-count stations in ALPO during spring and early summer 2007-2009, two tributaries host a diverse avian community that likely indicates high ecological integrity of biotic conditions in these parks. In particular, these tributaries host bird species assemblages with life history attributes that are typically associated with more mature, extensive forests of the region. In contrast, the bird community present along UNT to Blair Gap Run (Foot of Ten) scored "medium integrity" indicating the bird community is comprised of fewer forest specialist species and more forest generalist species. Again, the bird community score is consistent with the apparent younger, less structurally diverse forest stand surrounding this stream (M.R. Marshall personal observation).

The BCI was initially developed for "snapshot" comparisons among sites rather than changes across years (O'Connell et al. 2000), and therefore conclusions about temporal changes in ecological integrity for these sites remain tentative. As such, two to three years of data on avian community composition provide means to establish baseline conditions rather than a basis for evaluating long-term trends. Substantial (e.g., two or more BCI categories) and consistent (e.g., >4 year trend) changes in tributary-specific BCI scores across years, however, may reflect significant ecosystem-level alterations. Such patterns will be evaluated in the future by comparing BCI scores to other vital signs as part of the long-term, integrated monitoring program in the ERMN in general and at ALPO in particular.

## Literature Cited


DeSante, D. F., J. F. Saracco, P. Pyle, D. R. Kaschube, and M. K. Chambers. 2008. Integrating the MAPS program into coordinated bird monitoring in the Northeast (US Fish and Wildlife Service Region 5). The Institute for Bird Populations, Point Reyes Station, CA.

Fancy, S. G., J. E. Gross, and S. L. Carter. 2009. Monitoring the condition of natural resources in US national parks. Environmental Monitoring And Assessment 151:161-174.

Griffith, M. B., S. A. Perry, and W. B. Perry. 1995. Macroinvertebrate communities in headwater streams affected by acidic precipitation in the central Appalachians. Journal Of Environmental Quality 24:233-238.

Jones, J., P. J. Doran, and R. T. Holmes. 2003. Climate and food synchronize regional forest bird abundances. Ecology 84:3024-3032.

Marshall, M. R., and N. B. Piekielek. 2007. Eastern Rivers and Mountains Network Ecological Monitoring Plan. National Park Service. Fort Collins, CO.

Mattsson, B. J. 2006. Louisiana Waterthrush ecology and riparian conservation in the Georgia Piedmont. PhD Thesis, the University of Georgia, Athens, GA, U.S.A.

Mattsson, B. J., and R. J. Cooper. 2006. Louisiana Waterthrushes (*Seiurus motacilla*) and habitat assessments as cost-effective indicators of instream biotic integrity. Freshwater Biology 51:1941–1958.

Mattsson, B. J., and M. R. Marshall. 2009a. Occupancy modeling as a framework for designing avian monitoring programs: a case study along Appalachian streams in southern West Virginia. *in* Proceedings of the Fourth International Partners in Flight Conference (T. D. Rich, C. D. Thompson, D. Demarest, and C. Arizmendi, Eds.), McAllen, TX.

Mattsson, B. J., and M. R. Marshall. 2009b. Streamside Bird Monitoring Protocol for the Eastern Rivers and Mountains Network. Technical Report NPS/NER/NRTR. National Park Service, Philadelphia, PA.

Mattsson, B. J., T. L. Master, R. S. Mulvihill, and W. D. Robinson. 2009. Louisiana Waterthrush (*Seiurus motacilla*), The Birds of North America. [Online.] Available at http://bna.birds.cornell.edu/bna/species/151.

Mulholland, P. J., C. T. Driscoll, J. W. Elwood, M. P. Osgood, A. V. Palumbo, A. D. Rosemond, M. E. Smith, and C. Schofield. 1992. Relationships between stream acidity and bacteria, macroinvertebrates, and fish - a comparison of north temperate and south temperate mountain streams, USA. Hydrobiologia 239:7-24.

Mulvihill, R. S., F. L. Newell, and S. C. Latta. 2008. Effects of acidification on the breeding ecology of a stream-dependent songbird, the Louisiana waterthrush (*Seiurus motacilla*). Freshwater Biology 53:2158-2169.

O'Connell, T. J., L. E. Jackson, and R. P. Brooks. 2000. Bird guilds as indicators of ecological condition in the central Appalachians. Ecological Applications 10:1706-1721.

O'Connell, T. J., L. E. Jackson, and R. P. Brooks. 1998. The bird community index: A tool for assessing biotic integrity in the Mid-Atlantic Highlands. Pennsylvania State University, University Park, Pennsylvania.

Perles, S. J., J. C. Finley, and M. R. Marshall. 2009. Vegetation and soil monitoring protocol for the Eastern Rivers and Mountains Network. Natural Resource Report NPS/ERMN/NRR—2009/XXX. National Park Service, Fort Collins, Colorado.

Roberge, J. M., and P. Angelstam. 2006. Indicator species among resident forest birds - A cross-regional evaluation in northern Europe. Biological Conservation 130:134-147.

Robinson, D. R. 1995. Louisiana Waterthrush (*Seiurus motacilla*). Pages 1-18 *in* The birds of North America, No. 151 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Acad. Nat. Sci., Philadelphia, PA, and Am. Ornith. Union, Washington, D. C.

Roy, A. H., A. D. Rosemond, M. J. Paul, D. S. Leigh, and J. B. Wallace. 2003. Stream macroinvertebrate response to catchment urbanisation (Georgia, U.S.A.). Freshwater Biology 48:329-346.

Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, results and analysis 1966–2007. Version 5.15.2008. Patuxent Wildlife Research Center, Laurel, MD.

Stucker, H. S. 2000. Biodiversity of southeastern Minnesota forested streams: relationships between trout habitat improvement practices, riparian communities and Louisiana Waterthrushes. MS Thesis, University of Minnesota, St. Paul, Minnesota, U.S.A.

Tzilkowski, C. J., A. S. Weber, and C. P. Ferreri. 2009. Benthic macroinvertebrate monitoring protocol for wadeable streams in the Eastern Rivers and Mountains Network. Natural Resource Report NPS/ERMN/NRR—2009/XXX. National Park Service, Fort Collins, Colorado.

Yahner, R. H., B. D. Ross, G. S. Keller, and D. S. Klute. 2001. Comprehensive inventory of birds in six Pennsylvania national parks. Technical Report NPS/PHSO/NRTR-2001/085.

Wood, P. J., and P. D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management 21:203-217.

Appendix A. Songbird species (n=42) detected in ALPO during streamside surveys 2007-2009. Species were assigned a priori to guilds for calculating Bird Community Index following O'Connell et al. (1998). See Table 2 for definitions of guild codes. Forest-interior species and specialist guilds highlighted in bold type.

| | | Compositional | | | | | Functional -- food acquisition | | | | | Habitat | | Nest placement | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Common name | Scientific name | EXNN | NPBP | RENM | TEMI | **SIBR** | OMNI | **BPIN** | **GGIN** | **LCIN** | **UCIN** | FOGE | **FIOB** | SHNE | **OGNE** | **FCNE** | **FGNE** |
| Mourning Dove | *Zenaida macroura* | | | X | | | | | | | | | | | | **X** | |
| Downy Woodpecker | *Picoides pubescens* | | | X | | | | **X** | | | | X | | | | | |
| **Pileated Woodpecker** | ***Dryocopus pileatus*** | | | X | | **X** | | **X** | | | | | **X** | | | | |
| Red-bellied Woodpecker | *Melanerpes carolinus* | | | X | | | | **X** | | | | X | | | | | |
| Northern Flicker | *Colaptes auratus* | | | X | | **X** | | | **X** | | | X | | | | | |
| Great Crested Flycatcher | *Myiarchus crinitus* | | | | | **X** | | | | | | X | | | | | |
| Eastern Phoebe | *Sayornis phoebe* | | | | X | | | | | | | X | | | | | |
| Eastern Wood-Pewee | *Contopus virens* | | | | | **X** | | | | | | X | | | | **X** | |
| **Acadian Flycatcher** | ***Empidonax virescens*** | | | | | **X** | | | | | | | **X** | | | **X** | |
| Blue Jay | *Cyanocitta cristata* | | X | X | | | X | | | | | X | | | | **X** | |
| Common Raven | *Corvus corax* | | X | X | | **X** | X | | | | | | **X** | | | **X** | |
| American Crow | *Corvus brachyrhynchos* | | X | X | | | X | | | | | | | | | **X** | |
| Brown-headed Cowbird | *Molothrus ater* | | X | | X | | X | | | | | | | | | | |
| Common Grackle | *Quiscalus quiscula* | | X | | X | **X** | X | | | | | | | | | **X** | |
| American Goldfinch | *Carduelis tristis* | | | X | | | X | | | | | | | X | | | |
| Field Sparrow | *Spizella pusilla* | | | | X | | X | | | | | | | | **X** | | |
| Song Sparrow | *Melospiza melodia* | | | X | | | X | | | | | | | | **X** | | |
| Eastern Towhee | *Pipilo erythrophthalmus* | | | | X | | X | | | | | X | | | | | **X** |
| Northern Cardinal | *Cardinalis cardinalis* | | | X | | | X | | | | | X | | X | | | |
| Rose-breasted Grosbeak | *Pheucticus ludovicianus* | | | | | | X | | | | | X | | | | **X** | |
| Indigo Bunting | *Passerina cyanea* | | | | | | X | | | | | | | X | | | |
| **Scarlet Tanager** | ***Piranga olivacea*** | | | | | **X** | | | | | **X** | | **X** | | | **X** | |
| Cedar Waxwing | *Bombycilla cedrorum* | | | X | | | | | | | | | | | | **X** | |
| **Red-eyed Vireo** | ***Vireo olivaceus*** | | | | | **X** | | | | | **X** | X | | X | | | |
| **Blue-headed Vireo** | ***Vireo solitarius*** | | | | X | | | | | **X** | | | **X** | | | **X** | |
| Northern Parula | *Parula americana* | | | | | **X** | | | | | | X | | | | **X** | |
| **Black-throated Blue Warbler** | ***Dendroica caerulescens*** | | | | | **X** | | | | **X** | | | **X** | X | | | |
| **Blackburnian Warbler** | ***Dendroica fusca*** | | | | | **X** | | | | | **X** | | **X** | | | **X** | |
| **Black-throated Green Warbler** | ***Dendroica virens*** | | | | | **X** | | | | | **X** | | **X** | | | **X** | |

| Common name | Scientific name | Compositional | | | | | Functional -- food acquisition | | | | | Habitat | | Nest placement | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EXNN | NPBP | RENM | TEMI | **SIBR** | OMNI | **BPIN** | **GGIN** | **LCIN** | **UCIN** | FOGE | **FIOB** | SHNE | **OGNE** | **FCNE** | **FGNE** |
| **Ovenbird** | ***Seiurus aurocapillus*** | | | | | **X** | | | **X** | | | | **X** | | | | **X** |
| **Louisiana Waterthrush** | ***Seiurus motacilla*** | | | | | **X** | | | | | | | **X** | | | | **X** |
| Common Yellowthroat | *Geothlypis trichas* | | | | X | | | | | **X** | | X | | X | | | |
| **Hooded Warbler** | ***Wilsonia citrina*** | | | | | **X** | | | | **X** | | | **X** | X | | | |
| **American Redstart** | ***Setophaga ruticilla*** | | | | | **X** | | | | **X** | | | **X** | | | **X** | |
| Gray Catbird | *Dumetella carolinensis* | | | | X | | X | | | | | X | | X | | | |
| Carolina Wren | *Thryothorus ludovicianus* | | | X | | | | | | **X** | | X | | | | | |
| **White-breasted Nuthatch** | ***Sitta carolinensis*** | | | X | | **X** | | **X** | | | | | **X** | | | | |
| Black-capped Chickadee | *Poecile atricapilla* | | | X | | **X** | | | | **X** | | X | | | | | |
| Blue-gray Gnatcatcher | *Polioptila caerulea* | | | | X | | | | | | **X** | X | | | | **X** | |
| Wood Thrush | *Hylocichla mustelina* | | | | | | X | | | | | X | | | | **X** | |
| American Robin | *Turdus migratorius* | | | X | | | X | | | | | | | | | **X** | |
| Ruby-throated Hummingbird | *Archilochus colubris* | | | | | | X | | | | | | | | | **X** | |

Appendix B. Detections of songbird species during point count surveys along tributary streams in ALPO, 2007-2009. Forest-interior obligate species are in bold. Scientific names are in Appendix A.

| Species | ALPO | | |
|---|---|---|---|
| | 2007 | 2008 | 2009 |
| Mourning Dove | | X | X |
| Downy Woodpecker | X | X | X |
| **Pileated Woodpecker** | **X** | **X** | **X** |
| Red-bellied Woodpecker | X | X | X |
| Northern Flicker | X | X | X |
| Great Crested Flycatcher | X | | X |
| Eastern Phoebe | X | X | X |
| Eastern Wood-Pewee | X | X | X |
| **Acadian Flycatcher** | **X** | **X** | **X** |
| Blue Jay | X | X | X |
| Common Raven | | X | |
| American Crow | X | X | X |
| Brown-headed Cowbird | X | | X |
| Common Grackle | | X | X |
| American Goldfinch | | X | X |
| Field Sparrow | | X | X |
| Song Sparrow | | X | X |
| Eastern Towhee | X | X | X |
| Northern Cardinal | X | X | X |
| Rose-breasted Grosbeak | X | X | X |
| Indigo Bunting | X | X | X |
| **Scarlet Tanager** | **X** | **X** | **X** |
| Cedar Waxwing | | X | X |
| **Red-eyed Vireo** | **X** | **X** | **X** |
| **Blue-headed Vireo** | **X** | **X** | **X** |
| Northern Parula | | | X |
| **Black-throated Blue Warbler** | | | **X** |
| **Blackburnian Warbler** | | **X** | **X** |
| **Black-throated Green Warbler** | **X** | **X** | **X** |
| **Ovenbird** | **X** | **X** | **X** |
| **Louisiana Waterthrush** | **X** | **X** | **X** |
| Common Yellowthroat | X | X | X |
| **Hooded Warbler** | | **X** | |
| **American Redstart** | | | **X** |
| Gray Catbird | | X | X |

| Species | ALPO | | |
|---|---|---|---|
| | 2007 | 2008 | 2009 |
| Carolina Wren | | X | X |
| **White-breasted Nuthatch** | **X** | **X** | **X** |
| Black-capped Chickadee | X | X | X |
| Blue-gray Gnatcatcher | | X | |
| Wood Thrush | X | X | X |
| American Robin | X | X | X |
| Ruby-throated Hummingbird | | | X |

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NPS 620/XXXXXX, February 2010

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